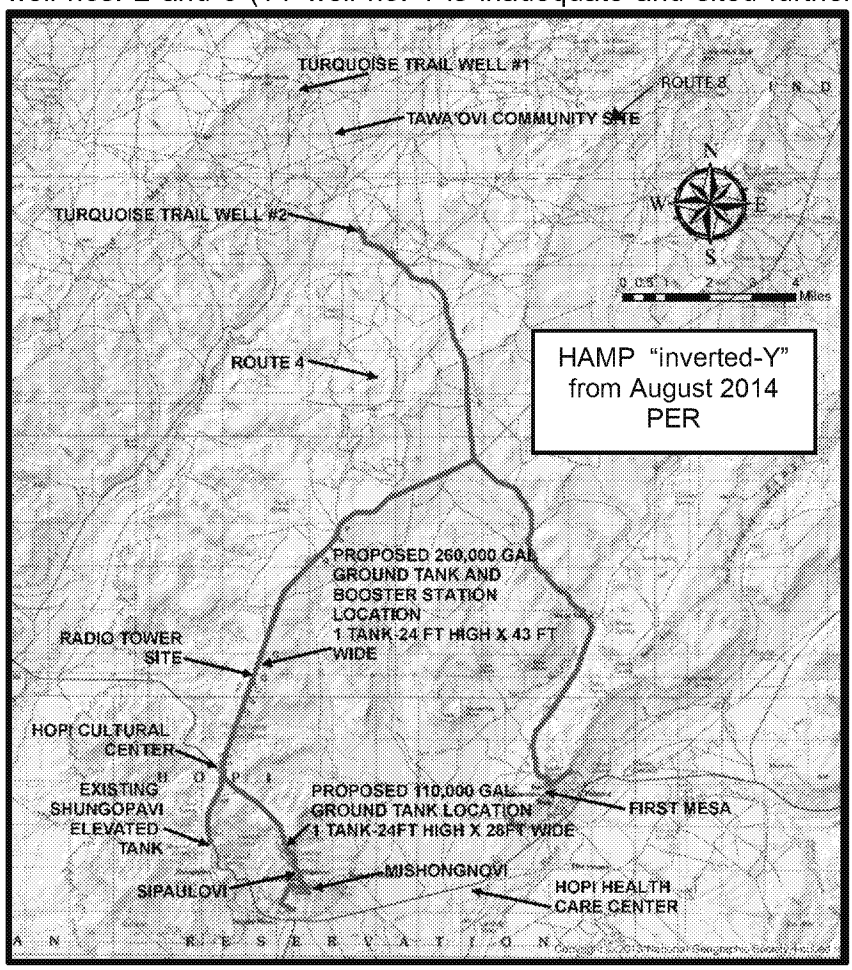
Executive Summary to: 10% Design Report for the Hopi Arsenic Mitigation Project, IHS Project Number PH 18-V31

Introduction: Eight (8) public water systems (PWS) in the First and Second Mesa areas of the Hopi Reservation do not comply, or struggle to comply, with the Federal Safe Drinking Water Act maximum contaminant level (MCL) of 10 parts-per-billion (ppb) arsenic (As) in the product of their community water systems. For those PWSs, naturally occurring levels of As in existing water supply source wells range from 12 – 35 ppb. Four village water systems are currently in violation of the 10 ppb As MCL, one tribal PWS, a Bureau of Indian Affairs (BIA) PWS and two (2) Bureau of Indian Education (BIE) PWSs comply intermittently with the As MCL by utilizing a variety of difficult and expensive to operate As-removal treatment systems.

The 2014 PER: In August of 2014 the Indian Health Service/Eastern Arizona District Office (IHS/EADO) published a document entitled: PRELIMINARY ENGINEERING REPORT FOR HOPI ARSENIC MITIGATION ALTERNATIVES, IHS Projects PH12-E73, PH11-E55, PH10-E37, PH08-T38, PH06-D33, PH04-S63. That preliminary engineering report (PER) specifically recommended that two separate five-year old, large-diameter, 2200-feet deep N-aquifer wells referred to as Turquoise Trail well nos. 2 and 3 (TT well no. 1 is inadequate and sited further northward) should serve as the supply source for a regional water transmission system that will provide potable water to the First and Second Mesa Hopi villages.



That system was to be configured as an "inverted-Y" with the source wells at the (top) base of the wye and the two arms of the wye supplying water to the FMCV utility and the Second Mesa village utilities respectively. The project was proposed to include multiple water storage tanks (WST), two pressure-boosting stations and a series of pressure reducing valve installations where potable water would descend from Upper Sipaulovi/Mishongnovi down to Lower Sipaulovi/Mishongnovi.

As described, the "inverted-Y" system layout was consistent with the system routing option which had been reviewed and approved by the Hopi Tribal Council in 2012. Un-funded cost estimates at the time for the "inverted-Y" system ranged from $16M – 18M. As described, that plan was the IHS' initial conceptualization of the Hopi Arsenic Mitigation Project (HAMP).

Project Funding Issues: The primary purpose of the August 2014 PER was to serve as the basis of information and justification for a project funding request to the United States Department of Agriculture–Rural Development (USDA-RD) program. If successful, that funding request would have provided 75% of remaining un-funded HAMP capital costs as a direct grant to the Hopi Tribe and a 40-year low-interest loan to the tribe as a means of financing the remaining 25% of project costs. Understandably, the need to repay a 25% loan over a 40-year period was not a preferred option among residents of the Hopi villages which would be participating in the HAMP effort.

Between 2014 and 2018, the Hopi Tribe sought to address Rural Development financial standards that would allow for Tribal submittal of a grant/loan application to that agency. In June 2017, the Hopi Utility Corporation (HUC) was chartered by the Hopi Tribe with the intent that the HUC would pursue a USDA-RD grant/loan on the Tribe's behalf. During that time, much dialogue and multiple meetings between the USDA-RD, the Hopi Tribe, the HUC, the United States Environmental Protection Agency (USEPA) and the IHS/EADO occurred. During those meetings, the USDA-RD expressed its support for village based As-removal treatment plants as opposed to a regional distribution system without treatment as was preferred by the Hopi Tribe, the USEPA and the IHS. The USDA-RD believed that it would be more cost effective to construct and operate individual treatment facilities in each of the First and Second Mesa villages to provide on-site treatment of the arsenic contaminated water which is sourced from local village-owned water supply wells.

In June of 2017 an expansive written response to the IHS/EADO August 2014 PER document was received by the IHS/EADO from the USDA-RD. That response was reasoned from the perspective that the USDA-RD could only assist with HAMP funding if a major project planning and design shift would be made to accommodate the USDA-RD preference for the construction and operation of multiple As-removal water treatment plants in the First and Second Mesa villages. Just prior to the USDA-RD response, the Hopi Tribal Chairman and the affected First and Second Mesa villages had officially stated their strongly-held preference for the regional water transmission/distribution system option, i.e. the HAMP.

During a Hopi Tribal Council meeting on 25 April 2018, the acting-IHS/Phoenix Area Sanitation Facilities Construction Director, Captain Eric Matson, announced that the IHS would fund $10M for the HAMP construction effort during FY 2018 and that the USEPA would fund an additional $4M over the next two-year period. The actual IHS allocation was subsequently increased to $11M. CAPT Matson also stated that, based on the most current IHS HAMP cost estimates, budget projections for subsequent funding cycles would very likely be adequate to meet the remaining $4M of un-funded project need. Those funding commitments, coupled with approximately $1.1M which has previously been committed through the HUC by the Hopi Tribe for electrical power main extensions to the Turquoise Trail wells, effectively meet the currently projected funding needs of the HAMP. At that point in time, and with a fully-funded project identified, the IHS/EADO engineering staff commenced with specific and detailed project design work for the HAMP.

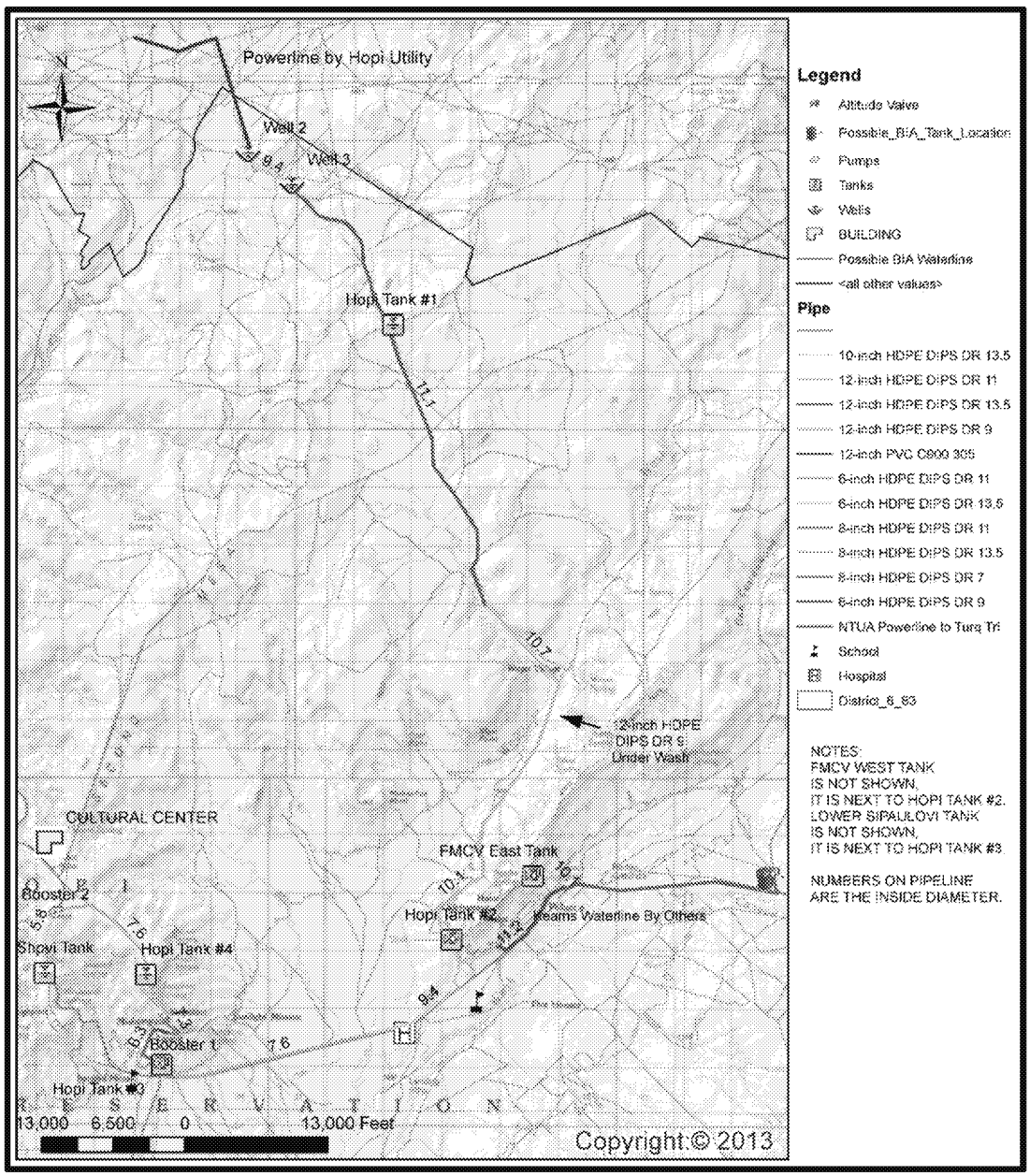
The 10% Design: Since the 25 April 2018 Hopi Tribal Council meeting, the IHS/EADO engineering staff, in consultation with HUC and Hopi HAMP village personnel, had further scrutinized the proposed 2014 PER "inverted-Y" HAMP layout from a hydraulic, economic, constructability and cultural compatibility perspective. On 10 July 2018, the IHS/EADO District Engineer, LCDR James Carter, distributed what was largely considered to be an internal 116-page document entitled 10% Design Report for the Hopi Arsenic Mitigation Project – IHS Project Number PH 18-V31. That document is significant because it further evaluates the "inverted-Y" HAMP system configuration from the 2014 PER, describes a variation of the "inverted-Y" referred to as the "inverted-V" and endorses an alternative to the "inverted-Y" HAMP system configuration.

The IHS-endorsed alternative HAMP system layout is referred to as the "J-hook" ("Updated Alternative B"). That plan resembles a leftward facing hook which is generally aligned southward along IR8 from the Turquoise Trail wells to the west side of First Mesa where it then arcs southwesterly along the north side of Hwy AZ 264 to Lower Sipaulovi/Mishongnovi before curving

sharply northward up-through Toreva to the top of Second Mesa where it supplies water to Upper Sipaulovi/Mishongnovi and all of Shungopovi. Collaterally, the Hopi Tribe's Cultural Center PWS and the BIE's Second Mesa Day School PWS would also be positioned to receive HAMP water from the proposed "J-hook" system layout.

A system alternatives evaluation table was prepared to consider the benefits and dis-benefits of the "inverted-V" ("Updated Alternative A"), and the "J-hook" system layouts. That table, with its criteria assumptions, is presented on pages 100 – 102 of the July 2018 10% design report.

Detailed topographical mapping and a system schematic of the "inverted V" layout are presented on pages 13 – 23 of the July 2018 10% design report. Detailed topographical mapping and a system schematic of the "J-hook" layout are presented on pages 24 – 33 of the report. The "J-hook" system layout is presented below as a ready means of comparison with the "inverted Y" layout as shown on page 1 of this document.



"J-hook" or "Updated Alternative B" HAMP system layout

Conclusions: Significant contrasting design details between the "inverted-V" and the "J-hook" HAMP system layouts are presented within the 10% design report. Also, a comparative review of the "inverted-V" and the J-hook" HAMP system layout options, reveals the following list of pros and cons between the two design options.

1. The previously referenced $1.1M funding commitment from the Hopi Tribe/HUC for the extension of NTUA electrical power to the Turquoise Trail wells is a critical component of the overall HAMP funding scenario. In addition, the most recent IHS/EADO construction cost estimate for the "inverted-V" design (exclusive of the power extension costs) is $21M while the estimated construction cost for the "J-hook" design is $19M which equals the fundable project amount that is listed in the IHS Project No. PH 18-V31 Project Summary document dated 29 August 2018. The estimated cost differential between the "inverted-V" layout with respect to identified available project funding is approximately $2M. That differential has not been identified to be met with future IHS or USEPA funding.
2. In contrast to the 2014 PER "inverted-Y" concept, the "J-hook" and the "inverted-V" system layouts both represent appreciable electrical pumping cost savings of approximately $19,000/year beginning with system start-up. Such savings are possible because only that water which is used by the utility systems on Upper-Second Mesa will require to be pumped up to those higher elevations. Those savings are likely to increase over time as community water demands and the cost of power ($/kW) increase into the future.
3. The "J-hook" system eliminates the need for a series of pressure reducing valves (PRV) between Upper and Lower Sipaulovi/Mishongnovi. PRVs are known to be high maintenance installations which are critical to long-term system operational stability. The failure of a PRV could produce downstream main line breaks and potentially dangerous pressures at lower elevations. The elimination of PRV's further simplifies the operation of the regional water system and reduces life cycle costs.
4. In contrast to the "J-hook" design, the "inverted-V" layout eliminates the need for a pressure booster station to be installed in Lower Sipaulovi. That booster station would operate in excess of 280-psi while the system piping between Upper and Lower Sipaulovi would be holding high pressures at the lower elevations of that hydraulic pumping zone. However, the "inverted-V" layout would require a booster station to be constructed near the Turquoise Trail wells. That booster station would operate at approximately 250-psi.
5. The "J-hook" design provides operational redundancy and facilitates O&M by siting two (2) HAMP-system WSTs where they can be manually backed-up by existing village WSTs.
6. While the "J-hook" system is more linear than the "inverted V" layout, it does not allow water to enter a village utility piping system and then transfer later to the distribution system of another village utility. Thus, all water from the Turquoise Trail HAMP wells will remain in HAMP transmission pipelines until it is automatically transferred directly into village utility WSTs from which it cannot flow back into the HAMP piping network. This configuration allows the HUC to serve as a direct wholesale water provider with each of the village PWSs classified as "consecutive" public water systems.
7. Both layout options provide full capacity to meet estimated 40-year water-system demands. Several key design modifications will need to be specified if the previously referenced BIA and BIE facilities elect to become customers of the HUC by direct connections to the HAMP system as proposed. Those modifications include increasing the system hydraulic capacity with the addition of an additional source well, an additional WST to serve as a transmission main supply buffer and larger transmission piping in several key areas between the Turquoise Trail Wells and the FMCV.
8. The "J-hook" system-layout eliminates 45,000-feet of pipeline that would need to be installed in "sandstone" which can be quite expensive on a "per-foot" basis. In addition, it

is likely that several more months of construction time would be required for that additional pipeline installation.

For the reasons presented in this Executive Summary to the 10% Design Report for the Hopi Arsenic Mitigation Project, IHS Project Number PH 18-V31 document, the IHS/EADO has determined that the Hopi Hamp villages and their HUC utility operations organization will be best served over the long-term by the "J-hook" HAMP system design configuration.

To that end, it is important to review the 10% design report document in detail to fully evaluate the differences between the "inverted-V" and the "J-hook" layout options. Thus, this executive summary should be received as a companion document to the 10 July 2018 10% Design Report for the Hopi Arsenic Mitigation Project, IHS Project Number PH 18-V31.